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Control of Cranberry Fruit Rots by Spraying

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CRANBERRY GROWERS frequently suffer serious losses from field and storage rots in the cranberry fruits. The percentages of fruit lost through decays vary in different sections of the country, between individual bogs, and from year to year. The decays are caused by infection by various fungi. The most critical time for infection seems to be near the period of flowering. There may be a long interval between the initial infection and the appearance of decay on the fruit. An infection of the unopened flower bud may not become apparent until the berry is nearly mature or even until the berries have been stored for some time.

Where experience has shown that fruit rots have been serious, spraying with bordeaux mixture has been recommended.[1] [2] [3] [4] [5]

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[1] SHEAR, C. L. FUNGOUS DISEASES OF THE CRANBERRY. U. S. Dept. Agr. Farmers' Bul. 221, pp. 5–16, illus. 1905.

[2] BAIN, H. F. CRANBERRY DISEASE INVESTIGATIONS ON THE PACIFIC COAST. U. S. Dept. Agr. Bul. 1434, 29 pp. 1926.

[3] DRIGGERS, B. F. A COMPARISON OF DUSTS AND SPRAY TO CONTROL FUNGOUS DISEASES OF THE CRANBERRY. N. J. Agr. Expt. Sta. Bul. 450, 16 pp. 1927.

[4] WILCOX, R. B. A PROGRAM FOR CRANBERRY ROT CONTROL IN 1935. Amer. Cranberry Growers' Assoc. Proc. Ann. Mtg. 65: 22–24. 1935.

[5] BERGMAN, H. F., and WILCOX, M. S. THE DISTRIBUTION, CAUSE, AND RELATIVE IMPORTANCE OF CRANBERRY FRUIT ROTS IN MASSACHUSETTS IN 1932 AND 1933, AND THEIR CONTROL BY SPRAYING. Phytopathology 26: 656–664, illus. 1936.

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However, in many cases, particularly in New Jersey, bordeaux has failed to give satisfactory control. In view of the great demand for cranberries for the armed forces as well as for civilian use during the war period, investigations to find a fungicide more satisfactory than bordeaux were carried out in 1943 and 1944. This circular summarizes the preliminary results, showing that the new fungicide ferric dimethyl dithiocarbamate, called Fermate, appears to be much more effective than bordeaux on seriously infected bogs.

MASSACHUSETTS TESTS

The more common fruit rots in Massachusetts are bitter rot,[6] fruit rot,[7] and end rot,[8] the first commonly appearing in the field and during the early part of the storage period and the last two later in the storage period. Serious losses from these rots occur on a few bogs almost every year and on a considerable number of bogs in occasional years. To compare the new fungicide, Fermate, with different numbers of applications and strengths of bordeaux, each treatment was replicated five times on each of two bogs on Cape Cod in 1944. Fruit rots were not serious during the 1944 season, and fruits in some of the unsprayed plots showed very little rot. The results of the more important treatments on one bog are summarized in table 1.

TABLE 1.—*Comparative effectiveness of Fermate and bordeaux mixture in controlling fruit rots of Early Black cranberry in Massachusetts, 1944*

Type of spray		Stage of flower or fruit development and date of spray application [1]				Scooped berries showing rot at harvest (October)
Material	Formula	Late-bud ("pod") stage (June 16–18)	20 percent of flowers open (July 11–12)	Flowering ended (July 28)	Small fruits present (Aug. 7)	
						Percent [2]
None						7
Bordeaux	10–10–100		+	+		5
Do	10–4–100		+	+		5
Do	10–4–100	+	+			3
Do	10–4–100	+	+	+		3
Do	10–4–100	+	+	+	+	3
Fermate	2–100	+	+	+		2
Do	2–100		+	+		2

[1] + indicates spraying.
[2] Bracketed values not significantly different from each other.

As has been found earlier for Massachusetts conditions, 10–4–100 bordeaux with a suitable spreader was as effective as 10–10–100 bordeaux in the control of fruit rots.

One important result of this experiment was the smaller amount of fruit rot when the bordeaux spray was applied early, when almost all the flowers were in the late-bud ("pod") stage, than when this early application was omitted. However, when Fermate was applied under these conditions of light rot infection, there was no increase in the amount of rot when the early application was omitted.

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[6] Caused by *Glomerella cingulata vaccinii* Shear.

[7] Caused by *Diaporthe vaccinii* Shear.

[8] Caused by *Godronia cassandrae* Peck.

Fermate at the rate of 2 pounds per 100 gallons of water, under 1944 conditions, controlled rot as well as 10–4–100 bordeaux applied early, before the flower buds opened.

NEW JERSEY TESTS

The losses from cranberry rots have been particularly heavy in New Jersey, where decay often appears in the field before the berries are picked as well as after harvest. Field decay is most commonly due to early rot[9] and blotch rot.[10] Bitter rot, which is seldom of importance in New Jersey, may appear either before or after harvest, whereas end rot usually does not develop except in berries stored until November. For many years many New Jersey growers have sprayed their bogs with 8–8–100 bordeaux for rot control. The number of applications per season has ranged from two to five on different bogs, depending upon the usual severity of the rot. In certain locations even five applications of bordeaux have failed to give satisfactory control, and in seasons when rot is very prevalent the customary spray programs with bordeaux have been generally ineffective.

In New Jersey, in 1943, Fermate was given a preliminary test in comparison with bordeaux at the single concentration of 3 pounds per 100 gallons of water. Five times during the season Fermate and bordeaux were applied to small replicated plots in a bog of Howes cranberries where bordeaux had previously failed to give control. The results, summarized in table 2, were strikingly in favor of Fermate. Most of the rot appeared in the berries before harvest. A detailed discussion of these results has already been given.[11]

TABLE 2.—*Comparative effectiveness of Fermate and bordeaux mixture in controlling fruit rots of Howes cranberry in New Jersey, 1943*

Type of spray		Spray applications	Scooped berries showing rot at harvest (October)
Material	Formula		
		Number	*Percent*
None		0	90
Bordeaux	8-8-100	5	58
Fermate	3-100	5	5

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[9] Caused by *Guignardia vaccinii* Shear.

[10] Caused by *Acanthorhyncus vaccinii* Shear.

[11] WILCOX, R. B. THE FIRST TEST OF FERMATE, A NEW FUNGICIDE, ON CRANBERRIES. Amer. Cranberry Growers' Assoc. Proc. Ann. Mtg. 74: 18–23. 1944.

More extensive tests were made in 1944, using three and five applications of both Fermate and bordeaux and testing Fermate as a spray at concentrations of 1, 2, and 3 pounds per 100 gallons of water and as a 10-percent dust diluted with talc. Replicated treatments were applied on Early Black cranberries in a bog where rot had previously been very severe. No counts were made when the fruit was picked, but it was observed that most of the berries on the unsprayed vines were rotten, that the fruits on all Fermate plots were mostly sound, and that those on the bordeaux plots showed a small amount of rot. The berries from all plots were harvested and stored for 2 months before they were sorted. Considerable rot, principally end rot, developed in storage. The results of the test are summarized in table 3.

Table 3.—*Comparative effectiveness of Fermate and bordeaux mixture in controlling fruit rots of Early Black cranberry in New Jersey, 1944*

Type of spray or dust		Stage of flower or fruit development and date of spray application[1]					Scooped berries showing rot 2 months after September harvest[2]
		62 percent of buds still closed (June 16)	Many fruits set and only 14 percent of flowers still open (June 30)	Stage of fruit development			
Material	Formula			Early (July 15)	Intermediate (July 28)	Advanced (Aug. 12)	
							Percent[3]
None	----------	----------	----------	----------	----------	----------	92
Bordeaux	8-8-100	+	+	+	----------	----------	63
Do	8-8-100	+	+	+	+	+	60
Do	8-4-100	+	+	+	+	+	59
Fermate	1-100	+	+	+	+	+	39
Do	10-percent (dust)	+	+	+	+	+	38
Do	2-100	+	+	+	----------	----------	30
Do	2-100	+	+	+	+	+	28
Do	3-100	+	+	+	+	+	17

[1] + indicates spraying.
[2] Both field and storage rots included.
[3] Bracketed values not significantly different from each other.

It will be seen from table 3 that all Fermate treatments gave lower percentages of berries with rot than did bordeaux and that the degree of control with Fermate sprays depended upon the concentration of the fungicide. The extent to which Fermate at the concentration of 3 pounds per 100 gallons resulted in better rot control than did 8-8-100 bordeaux is illustrated in figure 1. The Fermate-sprayed berries were conspicuously brighter in appearance. It would appear from these 1944 results that the last two applications of both bordeaux and Fermate were ineffective in reducing rot significantly. It should not be concluded that this would necessarily be true in a season of normal rainfall, because in 1944 the rainfall was negligible during the 2 months following the third application of the fungicides.

The amount of Fermate in pounds per acre applied in the form of dust was the same as the amount applied as a spray at the rate of 3 pounds per 100 gallons of water, but the control of rot (largely end rot in storage) was only equivalent to that obtained from Fermate spray at the 1-pound concentration. Rot control with dust might be even less effective in a rainy season. This indicates that Fermate dust in the form and manner applied should not be relied upon for the control of severe cases of rot.

Fermate sprays were also tried on a commercial scale (up to 30 acres) in comparison with bordeaux mixture by several New Jersey growers in 1944. In one case so little rot developed that no significant difference was noted between the two fungicides. In all other commercial trials the results were in favor of Fermate.

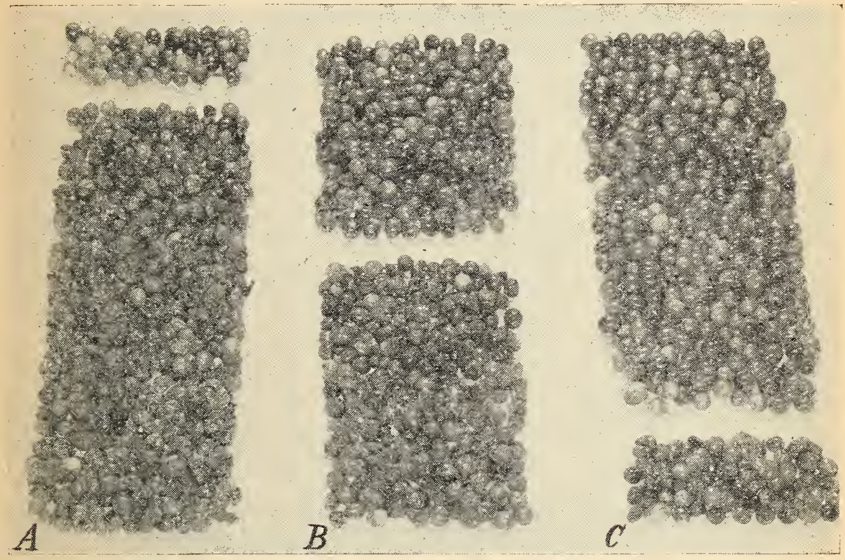

Figure 1.—The proportion of decayed and sound berries following (*A*) no spray, (*B*) five applications of 8–8–100 bordeaux, and (*C*) five applications of 3–100 Fermate, as indicated by the relative areas covered by the decayed (lower) and by the sound (upper) berries.

DISCUSSION

The tests reported herein have shown that in New Jersey, under conditions of heavy fungus infection, Fermate gave better control of cranberry fruit rots than did bordeaux. Although in Massachusetts in 1944, with a relatively light fungus infection, bordeaux gave as good control as Fermate, in earlier work spraying with bordeaux did not always control rot. Therefore, where control of fruit rots by bordeaux sprays has not been satisfactory, the use of Fermate is suggested.

The 1944 results, showing that the fourth and fifth applications of either Fermate or bordeaux did not give significantly greater rot control than that produced by the first three applications, emphasize the importance of the early applications. Previous observations in

New Jersey indicated that the last two applications of bordeaux helped in rot control in some seasons, but conclusive evidence is still lacking.

The proportions of copper sulfate and lime in the bordeaux did not appear to influence the degree of rot control, but an 8–4–100 mixture has the advantage over an 8–8–100 mixture in leaving less residue on the fruit and requiring a smaller bulk of ingredients for the same amount of spray.

SPRAY RECOMMENDATIONS

On the basis of the past 2 years' results in comparing Fermate with bordeaux as a spray for the control of cranberry fruit rots, the following spray program with either Fermate or bordeaux is suggested.

First spray.—During the late-bud ("pod") stage, but before appreciable flowering.

Second spray.—At the end of the flowering period.

Third spray.—Two weeks after the second spray.

Where fruit decay has been extremely serious, a fourth and possibly a fifth spray might reduce rot.

Fourth spray.—About 2 weeks after the third spray.

Fifth spray.—About 2 weeks after the fourth spray.

On bogs where fruit rots have been serious, Fermate at the rate of 3 pounds in 100 gallons of water may be expected to give better rot control than bordeaux of any strength.

Users of Fermate should protect their faces and hands against possible burning. As Fermate is very inflammable, do not smoke or light matches while using it.

If Fermate is not available, a bordeaux mixture of 8 pounds of commercial copper sulfate with 4 pounds of hydrated lime in 100 gallons of water will considerably reduce fruit rot. In bogs with light fungus infection it may give as good control as Fermate.

With bordeaux, 1 pound of calcium caseinate spreader, or 1 pound of rosin fish-oil-soap spreader, in each 100 gallons of spray is recommended. With Fermate no spreader is recommended.

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